The nutritional value of goat meat

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Abstract: *Information on the nutritional value of goat meat is one of extreme paucity. Although the meat is widely consumed and is an important source of animal protein in most developing countries, surprisingly few studies have been undertaken on the nutritional properties of the meat. Three types of goat meat are consumed: meat from kids, meat from young goats, and meat from old goats. The per caput supplies of goat meat over the last 20 years are decreasing consistently in all regions of the developing world. A widening gap between production and consumption has resulted in increased prices. The chemical composition of goat meat is as follows: moisture, 74.2–76.0%; protein, 20.6–22.3%; fat, 0.6–2.6%; ash, 1.1%. Goat meat appears to contain more arginine, leucine, and isoleucine than mutton and is adequate in all the essential amino acids. Goat meat also has a relatively lower fat content because the tissue is more concentrated in the viscera. The fatty acid composition of subcutaneous, kidney, and intermuscular fat depots appears to be similar to that of sheep, except that goats tended to have more oleic acid (C18:1) in their fat depots. The implication of this feature is an increased value of the purchased product (lean meat). The Ca content of goat meat is inferior to that of beef. Goat meat has higher thiamine and riboflavin contents in the liver, but niacin was lower than that in beef. Management factors affect the proximate composition of the meat and the eating quality, especially tenderness, flavour, and juiciness. Castration tends to increase the fat content of the meat. Toughness of the meat is related to age at marketing, collagen content and solubility, size of muscle fibres, and muscle contraction. Limited data suggest that the inclusion of up to 70% goat meat in fresh and smoked sausages significantly increased the flavour and acceptability.*

Résumé: *L'information sur la valeur nutritive de la viande caprine est d'une extrême rareté. Même si la consommation de cette viande, source importante de protéines animales dans la plupart des pays en développement, est répandue, on s'étonne du petit nombre d'études sur ses propriétés nutritives. On consomme trois sortes de viande de chèvre : la viande de chevreau, la viande de jeune chèvre et la viande de chèvre âgée. Au cours des 20 dernières années, la production per capita de cette viande n'a cessé de diminuer dans toutes les régions du monde en développement. L'augmentation de l'écart entre la production et la consommation a entraîné une hausse des prix. La composition chimique de la viande caprine est la suivante : humidité : 74,2–76 %, protéines : 20,6–22,3 %, gras : 0,6–2,6 %, cendres : 1,1 %. Cette viande renferme davantage d'arginine, de leucine, d'isoleucine que la viande ovine; tous les acides aminés essentiels y sont en quantité suffisante. De plus, sa teneur en gras est relativement plus basse en raison de la concentration des tissus graisseux dans les vicères. Par ailleurs, la teneur en acides gras des dépôts graisseux sous-cutanés, rénaux et intermusculaires de la viande caprine s'apparente à celle du mouton; toutefois, les réserves graisseuses de la chèvre renferment en général plus d'acide oléïque (C18 pour 1), d'où plus grande valeur du produit (la viande maigre) à l'achat. La teneur en Ca de la viande caprine est inférieure à celle de la viande bovine. Le foie de chèvre est plus riche en thiamine et en riboflavine, mais plus pauvre en niacine que celui du boeuf. La qualité des soins influe sur la composition approximative de cette viande et sa palatabilité, en particulier sa tendreté, son goût et sa texture juteuse. En général, la castration en augmente la teneur en gras. Quant à sa dureté, elle est fonction de l'âge de l'animal au moment de sa commercialisation, de sa teneur en collagènes et de sa solubilité, de la taille de ses fibres musculaires et de la contraction des muscles à l'abattage. Malgré leur nombre limité, les données disponibles indiquent que la présence de 70 % de viande caprine dans la saucisse fraîche ou fumée en améliore beaucoup le goût et l'acceptabilité.*

Resumen: *La información sobre el valor nutricional de la carne de cabra es extremadamente escasa. Aun cuando este tipo de carne se consume ampliamente y es una importante fuente de proteína animal en la mayor parte de los países en desarrollo, es sorprendente el hecho de que se hayan*

realizado pocos estudios sobre las propiedades nutricionales de la misma. Son tres los tipos de carne de cabra que se consumen: carne de cabritos, de cabras jóvenes y de cabras adultas. Los suministros per capita de carne de cabra durante los últimos 20 años están disminuyendo consistentemente en todas las regiones del mundo en desarrollo. Un abismo que se amplía entre la producción y el consumo ha originado un aumento de los precios. La composición química de la carne de cabra es como sigue: humedad, 74,2–76,0%; proteína, 20,6–22,3%; grasas, 0,6–2,6%; ceniza, 1,1%. La carne de cabra parece contener mAs arginina, leucina e isoleucina que la de carnero y tiene una coposición adecuada de aminoácido relativamente bajo de grasa porque el tejido está más concentrado en las vísceras. La composición ácido-grasa de los depósitos subcutáneos, riñones y de grasa intermuscular parece ser similar a la de la oveja, excepto por el hecho de que las cabras tienden a tener un mayor contenido de ácido oléico (C18:1) en sus depósitos de grasa. La implicación de esta característica es un aumento en el valor del producto que se compra (carne magra). El contenido de Ca de la carne de cabra es inferior al de la carne de res. La carne de cabra tiene contenidos más altos de tiamina y riboflavina en el hígado, pero el contenido de niacina es menor que en el de la res. Los factores de explotación afectan la composición futura de la carne y la calidad al comerse, especialmente la blandura, sabor y jugosidad. La castración tiende a incrementar el contenido de grasa de la carne. La dureza de la carne está relacionada con la edad en el momento de la comercialización, el contenido de colágeno y la solubilidad, el tamaño de las fibras musculares y la contracción muscular. Información limitada sugiere que al incluir hasta un 70% de carne de cabra en salchichas frescas y ahumadas aumentó significativamente su sabor y aceptabilidad.

In many parts of the tropics and especially in those countries with high goat populations, goat meat is highly relished and sought after. It is the meat of choice and demand often exceeds supply, such that the prices of both the meat and the live animals are often the highest on the farm. This pattern exists in many developing countries (Devendra and Owen 1983; Devendra 1987). There has also been a trend toward consumer substitution of goat meat with imported mutton, often of inferior quality.

Three types of meat are consumed in the developing countries (Devendra 1981):

- Meat from kids (8–12 weeks);
- Meat from young goats (1–2 years); and
- Meat from old goats (2–6 years).

Kid meat is a speciality common mainly in Latin America, the Caribbean, parts of Africa, and Southeast Asia. Kids are slaughtered at weights of 6–8 kg. Young goat is the most common type consumed and is the main topic of discussion in this paper. In terms of quality, the best young goat meat is produced at a live weight range of 11–25 kg, depending on breed and environment. Owen (1975), for example, in a study of goats slaughtered at 4–8, 9–14, and 15–24 months, reported that mature goats were superior to younger goats in meat production. Likewise, yearling (12–20 months) Angora goats produced chops and roasts that were juicier and more tender ($P < 0.05$) than those from 3- to 5-month-old kids (Smith et al. 1978). Goat meat is consumed in three forms: fresh, chilled, or frozen; fresh meat is by far the most popular.

There are several factors closely associated with the extent and pattern of goat meat consumption: regional differences, systems and intensity of production, ownership, affluence, ethnology, and religion. Developing countries account for 93% of world goat meat production and consume the bulk of this production. Developing countries produce only 7% of the world's goat meat and much of this meat is consumed by the immigrant populations of North America, Europe, Australia, and New Zealand. Although goat meat is widely consumed, knowledge of its nutritive value is extremely limited. The sparse knowledge base is a reflection of the degree of appreciation of goat meat in qualitative terms and, despite its

quantitative importance, the extent to which it has been taken for granted. This paper summarizes the present knowledge of the nutritional characteristics of goat meat.

Patterns of consumption

The percentage of indigenous production of carcass meat accounted for by goat meat is generally small (3.9–9.4%) and decreasing, being highest in Africa and Asia (Table 1), with 88% of the world goat population. In relation to decreasing production and without exception, there is also a decreasing trend in per caput production; the highest per caput goat supply is in Africa, followed by Asia (Table 1).

Demiruren (1982) projected that in 14 selected countries the demand for goat meat and milk in 1990 will require a 2.8% increase in production above the present per caput consumption. Given the present static growth rates of these products and the decreasing per caput supply (Table 1), however, it is unlikely that this 2.8% increase will be met. The Technical Advisory Committee report (TAC 1985) also indicates that the gap between production and consumption is increasing faster for goat meat than for other food commodities.

There are four major developments concerning the trends in Table 1:

- Inadequate goat meat supplies have resulted in increased prices for the meat and the live goats, including the breeding animals;
- The high price of goat meat has encouraged unscrupulous substitution by imported mutton from poor-quality sheep;
- The demand for goat meat has encouraged increased slaughter of breeding animals with a consequent erosion of the base population in quantitative and qualitative terms; and
- The reduced availability of breeding animals has also resulted in some countries to shift from goat to sheep production.

In many developing countries, goats and sheep are traditionally owned by small farmers, peasants, and landless agricultural labourers, to whom the ownership of these animals had significant nutritional, socioeconomic advantages. Their

Table 1. Percentage of the indigenous production of carcass meat accounted for by goat and per caput goat meat in 1961-1965, 1974, and 1984 throughout the world.

	% of indigenous production[a]			Per caput goat meat supply[b] (kg/year)		
Region	1961-65	1974	1984	1961-65	1974	1984
Africa	9.9	8.2	9.4	1.20	0.91	1.13
North America	0.1	0.1	0.1	0.06	0.06	0.08
South America	1.0	0.5	0.6	0.43	0.32	0.24
Asia	5.0	3.9	3.9	0.47	0.40	0.44
Oceania	0.1	0.1	0.1	0.12	0.10	0.11

Source: FAO (1974, 1984).
[a]Percentage of beef and veal, mutton and lamb, goat, buffalo, pig, and poultry meat.
[b]Includes offals.

Table 2. Proportion (%) of households reporting the purchase of goat meat and imported mutton by income and race in Peninsular Malaysia.

Monthly household income (MYR)[a]	Malay		Chinese		Indian	
	Goat meat	Imported mutton	Goat meat	Imported mutton	Goat meat	Imported mutton
<100	2	38	0	10	0	100
100-199	5	49	3	11	6	96
200-299	4	51	2	17	27	64
300-499	8	58	5	18	10	90
500	7	68	13	27	58	75

Source: Devendra (1983).
[a]In February 1988, 2.4 Malaysian ringgits (MYR) = 1 United States dollar (USD).

small size, in particular, is of special significance and is related to biological, managerial, and economic factors (Devendra and Burns 1983).

In terms of the contribution to human nutrition, an important, often inadequately appreciated contribution of goats is their supply of animal proteins to the rural community. With particular reference to vulnerable groups, pregnant and nursing mothers, and young, the rearing of goats supplies a small but significant supply of high biological value animal protein in the form of meat and milk plus essential minerals and fat-borne vitamins. For little investment, goats provide an easy source of meat and milk to rural people who cannot afford to buy these products or are unable to survive rearing cattle and buffaloes. The magnitude of this contribution is not known, but it is likely much more significant than realized.

There is evidence that the demand for goat meat increases as income increases. At high income levels, people are willing to pay as much as two to three times the cost of imported mutton on account of demand being greater than supply. In Malaysia, for example, within all races, the demand for goat meat increased with increasing income (Table 2). Thus, it is implicit that if the demand for more animal protein is to be met and the quality of life is to be improved, to maximize production in Malaysia, all feed-production avenues must be fully exploited. The contribution of goats is important if this objective is to be achieved.

Nutritional characteristics

The moisture content of goat meat in India, Malaysia, and the Philippines varies from 74.2 to 76.0%; protein, 20.6–22.3%; fat, 0.6–2.6% (Table 3). The ash content is fairly constant around 1.1% and the Ca and P content are variable (Table 3). In general, the compositions of goat meat and mutton are comparable with respect to moisture, protein, and ash contents (Thulasi and Ayyaluswami 1983). The fat content was surprisingly lower in mutton despite the higher subcutaneous content of fat in sheep relative to goat meat. The nutritive value of goat meat reported in this study is comparable to the data of Rai (1969) for goat meat in Uttar Pradesh, India.

Protein

The protein component and especially the amino acid profile is the most important component of goat meat. Protein is especially important in the developing

Table 3. Chemical composition of goat meat in some countries.

Component	India[a]	Malaysia	Philippines[b]
Moisture (%)	74.2	74.0	76.0
Protein (g/100 g)	21.4	20.6	22.3
Fat (g/100 g)	2.6	2.2	0.6
Total carbohydrates (g/100 g)	-	-	-
Fibre (g/100 g)	-	-	-
Ash (g/100 g)	1.1	1.0	1.1
Ca (mg/100 g)	12	11	6
P (mg/100 g)	193	154	150
Fe (mg/100 g)	-	2.1	0.4

[a]Source: Gopalan et al. (1971).
[b]Source: Abdon et al. (1980).

Table 4. Amino acid composition (g/16 g N) of meat samples in India.

Amino acid	Goat meat	Mutton	Beef	Pork	Ideal protein
Arginine	7.4	6.8	6.8	7.1	6.6
Histidine	2.1	2.8	3.0	3.4	2.4
Lysine	7.5	7.9	8.1	8.7	7.5
Tryptophan	1.5	1.4	1.4	1.3	1.6
Phenylalanine	3.5	3.3	3.4	3.6	5.8
Methionine	2.7	3.1	2.9	3.4	2.8
Threonine	4.8	4.6	4.5	5.2	5.0
Leucine	8.4	7.6	7.5	8.2	10.0
Isoleucine	5.1	4.6	4.5	5.4	6.6
Valine	5.4	5.5	4.9	6.0	7.0
Tyrosine	3.1	3.0	3.4	3.5	0.0
Cystine	1.2	1.3	1.1	1.1	0.0

Source: Srinivasan and Moorjani (1974).

world, where there is a great need for dietary proteins of animal origin to provide a concentrated source of readily assimilable amino acids. The consequences of an inadequate supply of animal protein include such deficiency diseases as marasmus and kwashiorkor. The elimination of malnutrition because of deficient food quality and undernutrition arising from deficient food quantity is essential for the betterment of human life.

Goat meat contains more arginine, leucine, and isoleucine than mutton (Table 4). The pattern of the remaining amino acids is similar to that of mutton. Pork contains more histidine, lysine, methionine, threonine, and valine than beef, goat meat, and mutton (Table 4). A comparison with the essential amino acid pattern of the ideal protein in Table 4 showed that goat meat is approximately similar with respect to arginine, lysine, tryptophan, methionine, and threonine. Goat meat contains 87.5, 60.4, 82.0, and 81.8% of the essential amino acids, histidine, phenylalanine, leucine, isoleucine, and valine, respectively, compared with the ideal reference protein. Goat meat is adequate with respect to all the essential amino acids (Srinivasan and Moorjani 1974). The limiting amino acids are the sulphur-containing amino acids followed by valine and isoleucine. A comparison of the results with the FAO (1965) reference protein pattern indicated all the meats contained more than adequate amounts of the essential amino acids. The average biological values (BV) of goat meat, beef, and buffalo meat were 60.4, 68.6, and

59.5, respectively, based on feeding trials with rats fed a 10% level of protein (Mitra and Mitra 1945).

Fat

An important distinctive feature of goat meat, especially compared with mutton, is its fat distribution. A characteristic feature in goats is that they tend to deposit most of their fat internally (mesenteries, renal tract, and alimentary tract). This feature, together with the reduced deposition of subcutaneous fat, makes goat meat leaner than mutton or beef. This is seen, for example, in the results of measurements of the thickness of subcutaneous fat at a point 20 mm from the medical plane along the caudal edge of the 13th rib. This measurement on Boer goats at slaughter weights of 23, 32, and 41 kg gave values of 1.2, 1.8, and 3.4 mm; on four sheep breeds (Pedi, Merino, Dorper and S A Mutton Merino), values of 2.3–9.6, 3.4–9.8, 3.5–8.8, and 4.8–10.6, respectively, were obtained (Bruwer 1984). Therefore, in terms of cost per unit of lean meat and in nutritional terms, goat meat is preferable over mutton, beef, and pork. With feral goats in New Zealand, Kirton (1970) reported a complete absence of subcutaneous fat in the loin.

During growth, there is limited change in the composition of intramuscular fat. Perirenal and mesenteric fats have a high proportion of saturated stearic acid (C18:0) because of the process of biohydrogenation of unsaturated fats especially oleic (C18:1), linoleic (C18:2), and linolenic (C18:3) acids. The low content of subcutaneous fat in goat meat suggests that the content of polyunsaturated fatty acids (PUFA), which are beneficial to human nutrition, is also likely to be low. Ladipo (1974) reported that the caul and intermuscular fats from goats have a higher lipid concentration than subcutaneous fat and that intramuscular lipids consisted mostly of cholesterol and phospholipids. Duncan et al. (1976) showed that, as in sheep, depot glycerides in goat contain an abnormally high proportion of odd-numbered n-fatty acid and methyl-branched fatty acids. More recently, fatty acid contents of lipids from the triceps brachii, biceps femoris, and obliquus internus abdominis in Korean native goat meat have been reported by Ha et al. (1986) to be as follows, palmitic (C16:0), 24.5–25.6%; oleic, 55.2–59.6%; linoleic, 4.0–8.1%. Unsaturated fatty acids predominated (68.5–72.3%).

In the Sudan, Gaili and Ali (1985a) reported from comparative studies that goats tended to deposit more fat in the omentum and mesentery than sheep. By comparison, sheep deposited more fat in the carcass. In a continuation of this study, the fatty acid composition of fat depots was compared in Sudan Desert goats and sheep by Gaili and Ali (1985b). No significant species differences existed in the proportions of fatty acid and palmitic, stearic, and oleic acids accounted for more than 90% of the total fatty acids. Goats tend to have a slightly higher proportion of oleic acid and less linoleic acid than sheep in all fat depots (Table 5).

The relatively poor fat covering on the carcasses of goats implies that subcutaneous fat cannot be used as a predictor of yield for goats as it is for lamb and mutton carcasses. An alternative criterion must be used to classify and grade goat carcasses.

Minerals and vitamins

The mineral and vitamin contents of goat meat have been inadequately studied and only scattered information exists. In the Philippines, some useful data

Table 5. Proportions of fatty acids in the subcutaneous, intermuscular, and kidney fat depots of Sudan Desert goats and sheep.

	Subcutaneous			Intermuscular			Kidney		
Fatty acid	Goats	Sheep	SE[a]	Goats	Sheep	SE[a]	Goats	Sheep	SE[a]
Pentadecanoic	8.3	7.7	0.5	10.7	10.9	1.8	9.9	9.6	1.2
Palmitic	32.2	32.2	1.0	32.1	33.2	0.9	32.0	32.9	0.7
Stearic	28.9	30.1	1.9	28.0	28.9	0.9	27.5	28.1	0.8
Oleic	28.7	28.2	0.8	28.2	27.8	0.7	28.1	27.7	0.4
Linoleic	1.9	1.8	0.2	2.0	1.9	0.3	1.8	1.7	0.2

Source: Gaili and Ali (1985b).
[a]Standard error of the difference between the two means.

Table 6. Mineral and vitamin contents (mg/100 g) of goat meat and beef in the Philippines.

	Calcium		Phosphorous		Thiamine		Riboflavin		Niacin	
Component	Goat meat	Beef	Goat meat	Beef	Goat meat	Beef	Goat meat	Beef	Goat meat	Beef
Lean meat	12	96	127	194	0.10	0.10	0.56	0.20	3.6	6.4
Liver	17	26	172	310	0.51	0.16	2.79	0.96	10.6	5.4
Lungs	15	40	142	144	0.10	0.14	1.16	0.18	2.9	3.0
Kidney	15	44	189	184	0.65	0.24	5.70	2.56	4.0	5.2
Large intestines	-	13	-	28	0.04	0.04	0.14	0.08	0.5	0.2
Small intestines	20	20	886	173	0.04	0.07	0.19	0.32	0.7	1.5
Heart	8	18	154	181	0.61	0.33	3.82	0.59	5.4	4.8
Stomach	48	156	84	63	0.06	-	0.36	0.14	0.7	1.4

Source: Abdon et al. (1980).

have been published on the mineral and vitamin contents of different parts of lean meat as well as that of different organs of goat meat compared with beef. Concerning Ca, with the exception of the small intestines, goat meat is inferior to beef (Table 6). The small intestines of goats, however, have a P content that is approximately five times that of beef. The P content in kidneys was comparable in both goat meat and beef (Table 6). Goat meat has a higher thiamine content than beef in the liver, kidney, and heart. The riboflavin content was also higher in lean goat meat and in goat liver, kidney, heart, and stomach. The niacin content of beef and beef kidney was higher than in lean goat meat and goat kidney; however, goat liver and heart have higher niacin contents than beef liver and heart (Table 6).

Management factors and nutritional value

In India, Kansal et al. (1982) studied the effects of different methods of castration and vasectomy on the proximate composition and eating quality (palatability) of Alpine × Beetal bucks between 2 and 6 months of age (Table 7). The moisture content of the meat of intact goats was 76.4%. This decreased significantly ($P < 0.01$) in animals whose testes were removed at the age of 6 months. No significant differences were found in vasectomization at 2, 4, or 6 months, castration by burdizzo at 2 or 4 months, or testes removal at 2 months

Table 7. Effects of different methods of castration on moisture, protein, and fat contents of muscles and in vitro digestibility of meat protein of Alpine x Beetal bucks in India.

Method	Age[a]	Moisture (%)	Fat (%)	Protein (%)	Pepsin digestion (%)	Trypsin digestion (%)
Burdizzo	2	75.7±0.4	2.6±0.3**	19.6±0.3**	26.2±1.2**	46.3±3.0**
	4	76.7±0.2	1.3±0.1	20.6±0.4	28.4±2.8**	49.9±5.2*
Testes removal	2	76.2±0.8	1.6±0.1	20.7±0.6	22.5±4.3	37.1±4.2
	6	73.2±0.8**	2.5±0.2**	21.8±0.3	21.3±3.3	37.1±3.7
Vasectomy	2	75.5±0.7	2.4±0.3	20.6±0.5	19.5±2.4	33.2±4.8
	4	75.4±0.8	1.9±0.1**	20.0±0.6*	23.3±2.3*	41.8±3.5
	6	75.9±0.2	2.5±0.2**	20.1±0.4*	16.5±2.7	37.1±3.7
Intact control		76.4±0.7	1.3±0.2	21.7±0.6	16.7±1.7	34.2±1.6

Note: Values are the means of 14 determinations. *, $P < 0.05$; **, $P < 0.01$.
Source: Kansal et al. (1982).
[a]Age in months.

(Table 7). These results differ from those of Baillargeon et al. (1971), who observed that the mutton from intact lambs contained more water than that from lambs castrated by burdizzo.

Differences in protein content were statistically significant only in the cases of goats vasectomized at 4 or 6 months ($P < 0.05$) and in those castrated by burdizzo at 2 months ($P < 0.01$) (Table 7). Similarly, a slightly lower level of protein than in intact animals has been reported in sheep castrated by testes removal or by stopping blood supply to the testes (Baillargeon et al. 1971).

The intramuscular fat in intact goats was less than that in goats vasectomized, castrated by burdizzo, or with testes removed. The increase in intramuscular fat was statistically significant ($P < 0.01$) in goats vasectomized at 2, 4, or 6 months, castrated by burdizzo at 2 months, or with testes removed at 6 months (Table 7). In Botswana, Owen et al. (1978) found that castrated goats had a higher proportion of both dissectable and total fat in the carcass.

The eating quality or palatability of the meat is associated with tenderness, juiciness, flavour, and aroma. Kansal et al. (1982) undertook a sensory evaluation of Alpine × Beetal meat using a 1–9 scoring scale and reported that there were no differences in tenderness, flavour, or juiciness between intact goats and those castrated by burdizzo, with testes removed, or vasectomized. Similar results were obtained for mutton by Baillargeon et al. (1971). Smith et al. (1974), however, reported that goat meat was less tender than lamb, beef, and pork but compared favourably with beef and pork in juiciness. Kansal et al. (1982) also found that goats castrated by burdizzo at 2 or 4 months had significantly more pepsin- and trypsin-digestible proteins than intact goats (Table 7).

In South Africa, the palatability of goat meat is considered inferior to that of lamb and mutton and has been linked to the marketing of mature animals (van Tonder 1980). The collagen content was implicated and a comparison of muscles in the Boer goat compared with four sheep breeds (Pedi, Merino, Dorper, and S A Mutton Merino) revealed that the former had an inherently higher collagen content with low solubility (Heinze et al. 1986). Heinze et al. (1986) concluded

Table 8. Tenderness and cooking loss in the meat of Katjang goats in Malaysia.

Muscle	Tenderness[a]	Cooking loss(%)
Rectus femuris		
Male	37.6±3.5	4.3±0.9
Female	33.0±6.3	3.6±1.0
Longissimus dorsi		
Male	32.3±3.4	3.7±0.3
Female	27.8±2.4	3.8±0.3

Note: Four males and four females were used, each about 3.4 years of age.
Source: Devendra (1983).
[a]Warner-Bratzler shearing force value.

that an evaluation of collagen alone was insufficient for an assessment of tenderness or toughness and that other factors, especially the type of matrix formed by the collagen, the muscle fibres, and the state of muscle contraction must also be evaluated.

Tenderness is best evaluated by the Warner–Bratzler method, which measures shear force. Limited work has been done in Malaysia on this aspect (Devendra 1983). It was evident that the meat from does was more tender than that from intact Katjang bucks of the same age (Table 8). Cooking losses of the rectus femuris and longissimus dorsi muscles were also higher (3.8–4.3%) in entire bucks than in the does (Table 8).

In the Philippines, attempts have been made to include goat meat up to a level of 70% in sausages. Consumer judges rated 50% lean goat meat in both fresh and smoked sausages, which replaced 50% pork, as having the best flavour and acceptability among the four sausage preparations (50% goat meat:50% pork fat, 60% goat meat:40% pork fat, 50% goat:30% pork fat, and 70% pork:30% pork fat). It was concluded that with the proper pretreatment, goat meat can be used as the main ingredient in sausage recipes (Argañosa 1985).

Conclusions

The nutritional characteristics of goat meat have been inadequately studied. The information that is available is based on a few, scattered studies that, together, do not presently provide an understanding of the nutritional properties of goat meat. The limited evidence suggests that differences are likely to exist in proximate composition of the meat, type and quality of the fat, and mineral and vitamin contents. Other important differences in nutritional value are related to tenderness, flavour, juiciness, and palatability (eating quality) of the meat; these factors are associated with collagen content and solubility. The relatively poor fat covering in goat meat merits special consideration in the assessment of yield and carcass quality. Given these circumstances and considering the wide consumption of goat meat in the developing world, there is an urgent need for concerted research on the nutritional properties of goat meat.

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Proceedings of a workshop held in Tando Jam, Pakistan, 13–18 March 1988

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Abstract/Résumé/Resumen

Abstract: This publication presents the results of a workshop held in Tando Jam, Pakistan, 13–18 March 1988, that focused specifically on all aspects of goat meat production in Asia. The workshop addressed the factors affecting meat production (breeding, nutrition, reproduction, sex, management, animal health, and diseases), the nutritional value of goat meat, methods of slaughter, processing techniques, consumer preferences, and the national and international marketing of goats. The detailed discussions on these aspects were further highlighted by country case studies, prevailing situations, issues and policies, and potential for improving the prevailing patterns of production. An important session covered broader issues concerned with research and development, strategies for increasing production, and export potential, especially in Near East markets. These discussions enabled a definition of research and development priorities and the scope for increasing goat meat production.

Résumé: Cette publication fait le compte rendu d'un atelier tenu à Tando Jam, au Pakistan, du 13 au 18 mars 1988 et qui a porté sur tous les aspects de la production de la viande de chèvre en Asie. Il y a été question notamment des facteurs influant sur la production de la viande (sélection des espèces, nutrition, reproduction, sexe, gestion, santé animale et maladies), de la valeur nutritive de la viande de chèvre, des méthodes d'abattage, des techniques de transformation, des préférences des consommateurs et du marketing national et international des chèvres. En plus de discuter de ces questions en profondeur, les participants ont aussi abordé les points suivants : études de cas de certains pays, situations actuelles, enjeux et politiques, et possibilités d'améliorer les tendances actuelles de la production. Lors d'une séance importante, les participants se sont penchés sur des questions plus vastes concernant la recherche et le développement, les stratégies qui permettraient d'augmenter la production et les possibilités d'exportation, particulièrement vers les marchés du Proche-Orient. Ces discussions ont permis de définir des priorités en matière de recherche et de développement et de déterminer le potentiel de croissance de la production de la viande de chèvre.

Resumen: Esta publicación contiene los resultados de un taller celebrado en Tando Jam, Paquistán, del 13 al 18 de marzo de 1988, dedicado específicamente a todos los aspectos de la producción de carne de cabra en Asia. El taller estudió los factores que afectan la producción de carne de cabra (cruce, nutrición, reproducción, sexo, manejo, salud y enfermedades), el valor nutricional de la carne caprina, los métodos de sacrificio, las técnicas de procesamiento, las preferencias del consumidor y el mercado caprino nacional e internacional. Las discusiones detalladas sobre estos aspectos se vieron además enriquecidas con el potencial para mejorar los patrones prevalecientes de producción. Una de las sesiones importantes cubrió los aspectos más amplios de investigación y desarrollo, estrategias para el aumento de la producción, potencial de exportación, especialmente en los mercados del cercano oriente. Las discusiones permitieron determinar las prioridades de investigación y desarrollo así como las posibilidades para aumentar la producción de carne caprina.

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